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DEVELOPMENT OF ENZYMATIC HYDROLYSIS CARBON OIL*

Keywords: castor oil, ricinoleic acid, sebacic acid, lipase, enzymatic hydrolysis.

Castor oil, obtained from castor oil seeds, is a non-drying liquid oil and contains up to 85 % ricinoleic acid, and modern selective castor bean varieties make it possible to obtain oil with a ricinoleic acid content of up to 95 %. The main world producers of castor oil are India and China [1]. The share of these countries was 356 thousand tons of castor oil seeds out of 646 thousand tons of world collection. The cultivation of this culture is not only associated with high labor costs, but also requires the use of the most fertile lands.

Due to the high content of ricinoleic acid, castor oil is widely used in medicine and veterinary medicine, and properties such as high viscosity, oxystability and high density make it possible to use this oil in industry for various purposes. One of the most important areas in the use of castor oil is to obtain ricinoleic acid. It is of interest to medicine, since it has an effective bactericidal, anti-inflammatory and antiherpetic effect. However, the main area of its application is organic synthesis: obtaining a number of acids (sebacic, undecylenic and azelaic), heptanal, 2-octanol, surfactants and other valuable products [2].

Ricinoleic acid is produced by hydrolysis of castor oil, and then, when the hydrolysis conditions change (increase in temperature and alkali concentration), you can get sebacic acid. Alkaline hydrolysis is carried out in industry at 150 °C and 3.5 MPa, followed by acidification. The resulting product contains many impurities, in particular sodium sulfate, which is difficult to separate. In addition to the target ricinoleic acid, dicinoleic acid is formed, and at higher temperatures also tetra- and pentaricinoleic acids are formed too [2]. In this regard, to reduce the consumption of electric energy and raw materials, it is of interest to replace chemical hydrolysis with enzymatic one, which would make it possible to obtain ricinoleic acid in an individual form with a high degree of purity at a lower temperature and without increasing pressure [3].

Therefore, the aim of this work was to select a thermostable enzyme preparation with high catalytic activity and to develop effective method for the enzymatic hydrolysis of castor oil with a high viscosity.

As the enzyme used the drug Lipase from *Candida rugosa*, Type VII, freeze-dried (manufacturer Pushchinskie laboratory). Enzymatic activity was determined by the modified method of Ota, Yamada [4], it amounted to 825 units/mg.

Enzymatic hydrolysis of castor oil with lipase from Candida rugosa was carried out in a 3 L fermenter at the Innovation Center of Chemical Pharmaceutical Technologies of UrFU.

The yield of fatty acids (μM/ml) was determined by titration and calculated by the formula 1:

$$A = (O–K)\ T \cdot 100, \tag{1}$$

where O is the amount of 0.1 n alcohol solution of NaOH, which used to the titration of the sample, ml; K – the amount of 0.1 n alcohol solution of NaOH, which used to the titration of the control sample, ml; T is the alkali titer; 100 – conversion factor [2].

$$A = (7–0.5)\ 0.1 \cdot 100 = 65\ \mu M/ml$$

As a result of the experiments, it was found that first the acid yield increases, reaching a maximum by 22 hours, and then it decreases. The content of ricinoleic acid in the mixture was 82.5 %. The structure of the products was determined by gas-liquid chromatography and IR Fourier spectroscopy.

Thus, it was possible to develop a less energy-intensive method of enzymatic hydrolysis of castor oil using an immobilized enzyme preparation which replaced the chemical stage of alkaline hydrolysis in the traditional method of obtaining ricinoleic acid.

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THE EFFECT OF IRON OVERLOAD CONSUMED FROM FOOD*

Keywords: iron overload, food iron, forms of iron, effect of iron.

Plants are a fundamental source of iron in our diets. Iron can be consumed from the food directly or indirectly from vegetables and staple food crops through animal provender (an agricultural foodstuff). Moreover, iron is the fourth most abundant element in the earth's crust and an essential component of almost all biological systems. Humans need iron to produce energy, transport oxygen, and is useful in cellular proliferation, and elimination of pathogens [1, 2]. In this regard, it is necessary to monitor iron overload from food consumed by individuals whom may tend to suffer from hemochromatosis, a hereditary disorder which causes the body to absorb too much iron from food [3, 4]. Food Iron are basically in two forms, and these are heme iron and Non-heme iron. The heme iron is found in meat products (10–15% of daily dietary iron intake in populations that eat meat) and the non-heme iron is found in both plant foods and animal food sources, including meat [5].

Although, to a greater extent, most people consume a sufficient amount of iron to meet their physiological needs. However, absorption is limited owing to the effects